Developmental Testing Overview

April 2010

TEMAC T&E Refresher Course

Outline

- Why Test ?
- Why Developmental Testing (DT)?
- What is DT?
- Who are the Army's Developmental Testers?
- Areas of DT Emphasis
- DT in the Acquisition Cycle
- Ensuring Readiness for Initial Operational Test (IOT)
- Summary

Why Test?

- **Gather data that allows statistical inferences to be drawn to determine how well a system meets its requirements**
- **Risk mitigation; tradeoffs need to occur regarding resources (time, money, performance) versus risk to the program**
- **Assess technical and operational characteristics, performance, and safety as part of system effectiveness, suitability, and survivability**
- **Ensure reliable, safe, and best quality products possible for the Soldiers**

Why Developmental Testing (DT)?

- **DT addresses:**
  - **How well does the item work in its intended environment?**
  - **Is the system safe for use by troops/users (no operating hazards)?**
  - **What is the performance envelope?**
  - **How well does the item respond to stimuli?**
  - **How well does the item meet the performance criteria?**
  - **What are the cost-performance tradeoffs?**
  - **What are the design technical risks?**
  - **Is the system ready for IOT?**
- **DT is an iterative process**

What is DT?

Any engineering type test used to verify that design risks are minimized, safety of the system is certified, achievement of system technical performance is substantiated, and readiness for OT&E is certified.

- Generally requires instrumentation and measurements; highly characterized and calibrated facilities and test ranges
- Accomplished by engineers, technicians, and/or soldier/user personnel
- Conducted on component, subsystem, system, and system-of-systems
- Well controlled, verifiable, repeatable, and statistically valid
- Conducted throughout the system's life cycle
- Conducted by contractor and/or Government

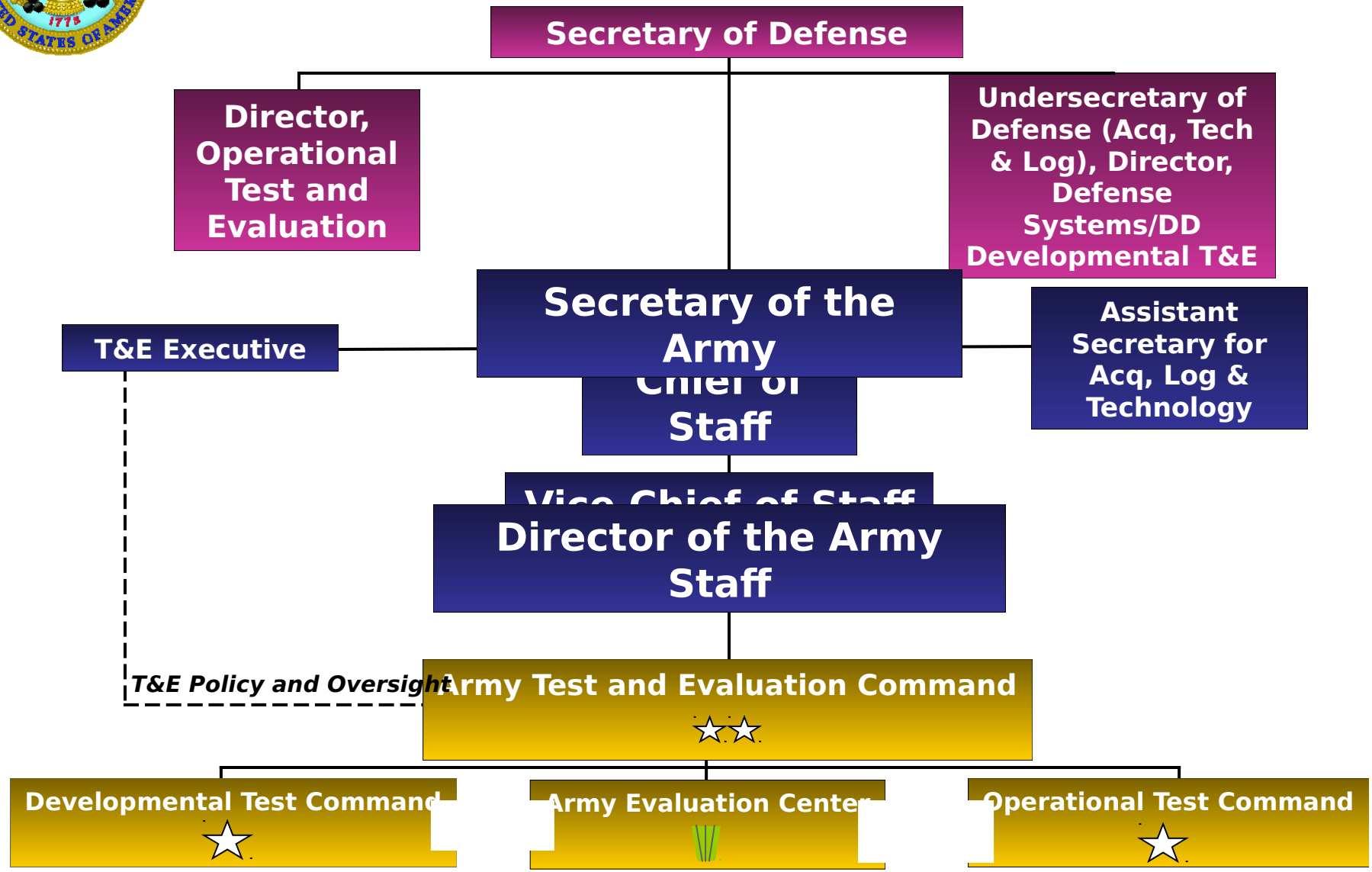
PM is responsible for the DT program

Who are the Army DT Organizations?

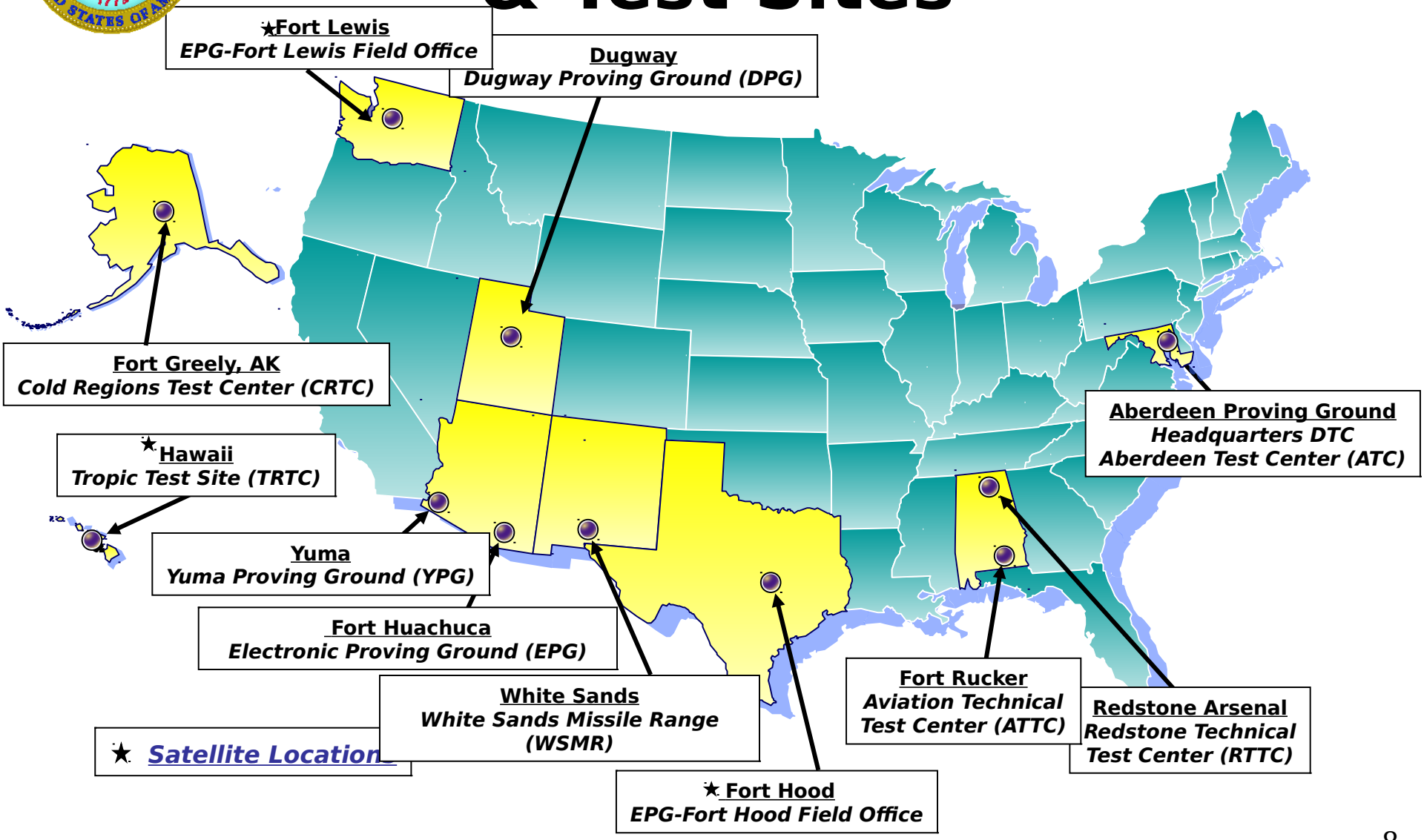
Developmental Test Command (DTC)
tests all systems except those as assigned below

- **Corps of Engineers – Commercial and Non-developmental items used for engineer maintenance and supply activities**
- **Communications-Electronics Command (By HQDA (CIO/G-6)) – C4/IT systems**
- **Space & Missile Defense Command – Strategic missiles and national missile defense programs (HELSTF, USAKA/RTS, and Ft. Greely, AK Test Bed)**
- **Medical Command – Medical systems**
- **Intelligence and Security Command – Classified or secure systems**

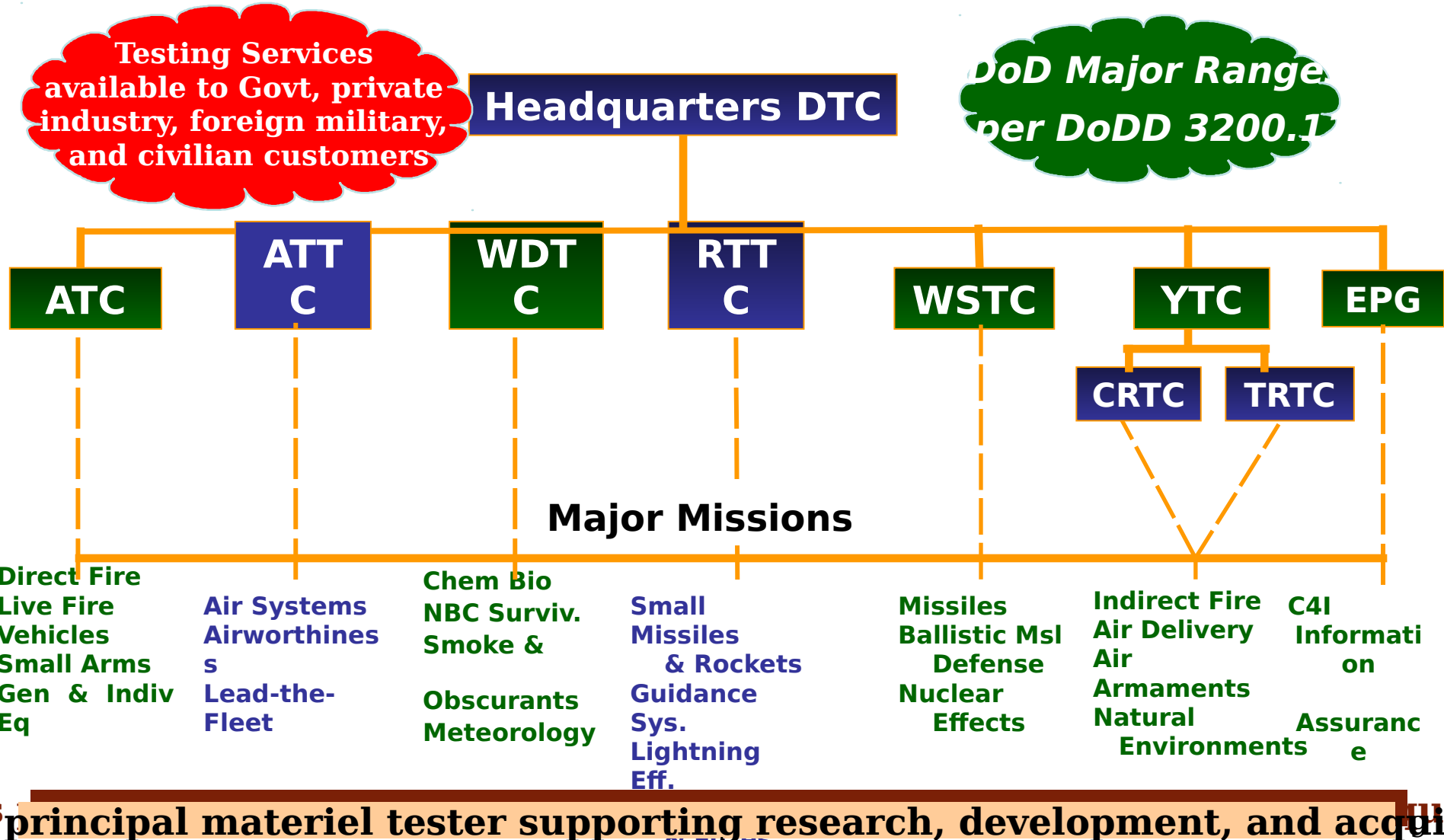
Where is DTC Within the DoD T&E Organizations?


Secretary of Defense
Director, Operational Test and Evaluation
Undersecretary of Defense (Acq, Tech & Log), Director, Defense Systems/DD Developmental T&E
Secretary of the Army
T&E Executive
Assistant Secretary for Acq, Log & Technology
Staff
Director of the Army Staff
T&E Policy and Oversight
Army Test and Evaluation Command
Developmental Test Command
Army Evaluation Center
Operational Test Command

DTC Major Ranges & Test Sites



DTC Organizational Structure



s principal materiel tester supporting research, development, and acqui

DTC Offers …

Expertise In:	Available Assets:
• Developmental Testing	• Workforce: 2700+ Civilians; 3000+ Contractors; experienced and educated
• Test Technology – initiatives such as Distributive Testing and Versatile Information System Integrated ON-line (VISION)	• Annual Products: 1800+ Tests; 300+ Test Reports; 150+ Safety Confirmations; 400+ Safety Releases
• Safety Verification (Safety Releases and Safety Confirmations)	• $5B Capital Investment: – Life Science Test Facility – Aerial Cable Range – Moving Target Simulator – Multiple Object Tracking Radar – Simulation Test Acceptance Facility – Superbox – Mine Test Facility – JERC / NACCITEC

Areas of DT Emphasis

- **Performance**
- **Integrated Logistics Support**
- **Reliability, Availability, and Maintainability (RAM)**
- **Manpower and Personnel Integration (MANPRINT)**
- **Safety Verification (Safety Release and Safety Confirmation)**
- **Environmental**
- **Survivability**
- **Interoperability**

Performance

- **Focuses on required or defined critical technical parameters, e.g.**
  - **accuracy**
  - **range**
  - **rate of fire**
- **Commodity area refines focus of emphasis**

Integrated Logistics Support

- **Adequacy of system support package**
- **Adequacy of tools, test equipment, and publications**
- **Personnel skill requirements**
- **Selection & allocation of spare parts, tools, test equipment, tasks to appropriate maintenance levels**
- **Transportability characteristics**

RAM

- Examine RAM characteristics under conditions that represent operational field conditions as much as possible
- Need large enough sample size to obtain confidence in results
- Test-Analyze-Fix-Retest allows for reliability growth to support a successful IOT
- Major product baseline changes may invalidate prior results leading to more expense as regression testing is required

Demonstrating Reliability in DT Enhances Reliability in OT

Reliability – probability that a system can perform a specified mission in specified time in a specified mission profile

Availability – measure of the degree to which a system is in an operable committable state at a given point in time

Maintainability – measure of the ability of an item to be retained in, or restored to, a specified condition when maintenance is performed

MANPRINT

- **Personnel Capabilities – cognitive and physical requirements for training, operation, maintenance, and sustainment**
- **Manpower requirements**
- **Training: individual and collective**
- **Soldier survivability**
- **Human factors engineering**
- **System safety**
- **Health hazards**

Use MOS-Qualified Military Personnel to the Extent Available

Safety Verification

Safety Release

A formal document issued by DTC before any hands-on testing, training, use, or maintenance by soldiers. A Safety Release is issued for a specific event at a specified time and location under specific conditions. It is a stand-alone document that indicates the system is safe for use and maintenance by soldiers and describes the sp em ba ns, and syst sis. Op an d. Th ailal tra

DTC's Responsibility

Safety Confirmation

A separate document issued by DTC that provides the materiel developer and the decision maker with the test agency's safety findings and conclusions, and that states whether the specified safety requirements have been met, includes a risk assessment for hazards not adequately controlled, lists any technical or operational limitations, and highlights any safety problems requiring further testing. For aviation testing, an Airworthiness Release does not negate the need for a Safety Confirmation.

Safety Release/Confirmation Matrix

Acquisition Event / DTC Document	Testing, Pre-Test Training, or Demonstrations Using Soldiers	MS B	MS C (LRIP)	Full-Rate Production Decision	Materiel Release Decision (Full/ Conditional/ Training)	Urgent Materiel Release (UMR)	Rapid Fielding Initiative / Rapid Equipping Force	System Changes (Modifica-tions and Upgrades)
Safety Release		✓	✓	✓	✓	✓	✓	✓
Safety Confirmation								

Safety Release

- Issued for a specific event
  - At a specified time
  - A specified location
  - Under Specified Conditions
- Describes Safety Hazards & Operational Limits

Safety Confirmation

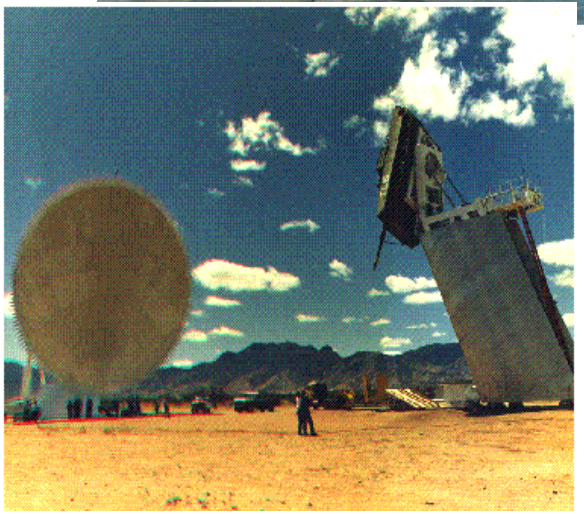
- Supports Milestones & Materiel Releases
- Provided to Both AEC & Materiel Developer
  - ndings &
  - Classifies any Residual Hazards

Environmental

- **Testing the system in adverse environments is critical to assess how it will operate**
- **This aspect of testing not often looked at during operational testing**
- **Environments can include: extreme cold, extreme hot, sand and dust, snow and ice, rain, salt fog, fungus, vibration, etc.**
- **Encompasses a balance of chamber testing, testing in natural environments, and m simulation**

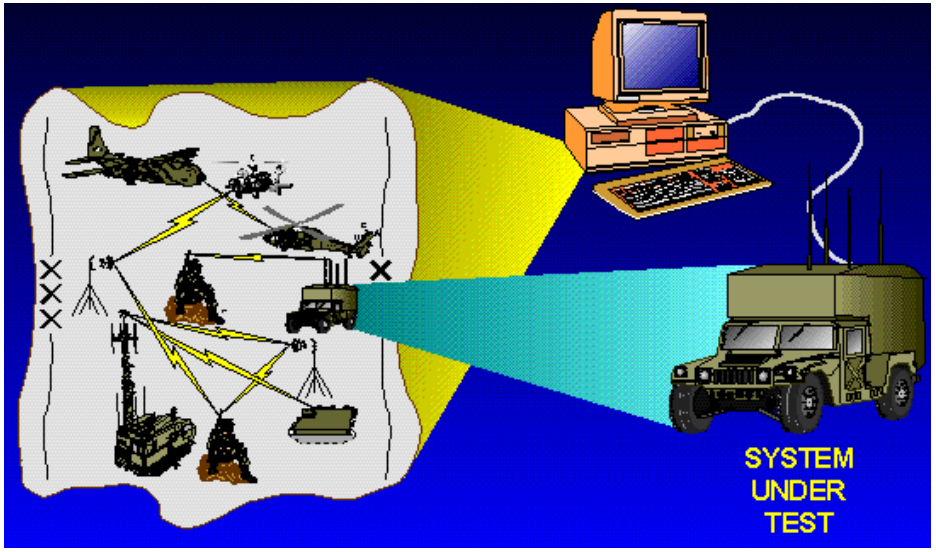
Survivability

- **Live Fire –**
  - **Vulnerability**
  - **Lethality**
- **NBC Contamination Survivability**
- **Information Assurance**
- **Nuclear Survivability**
- **Electromagnetic Environmental Effects(E3)**

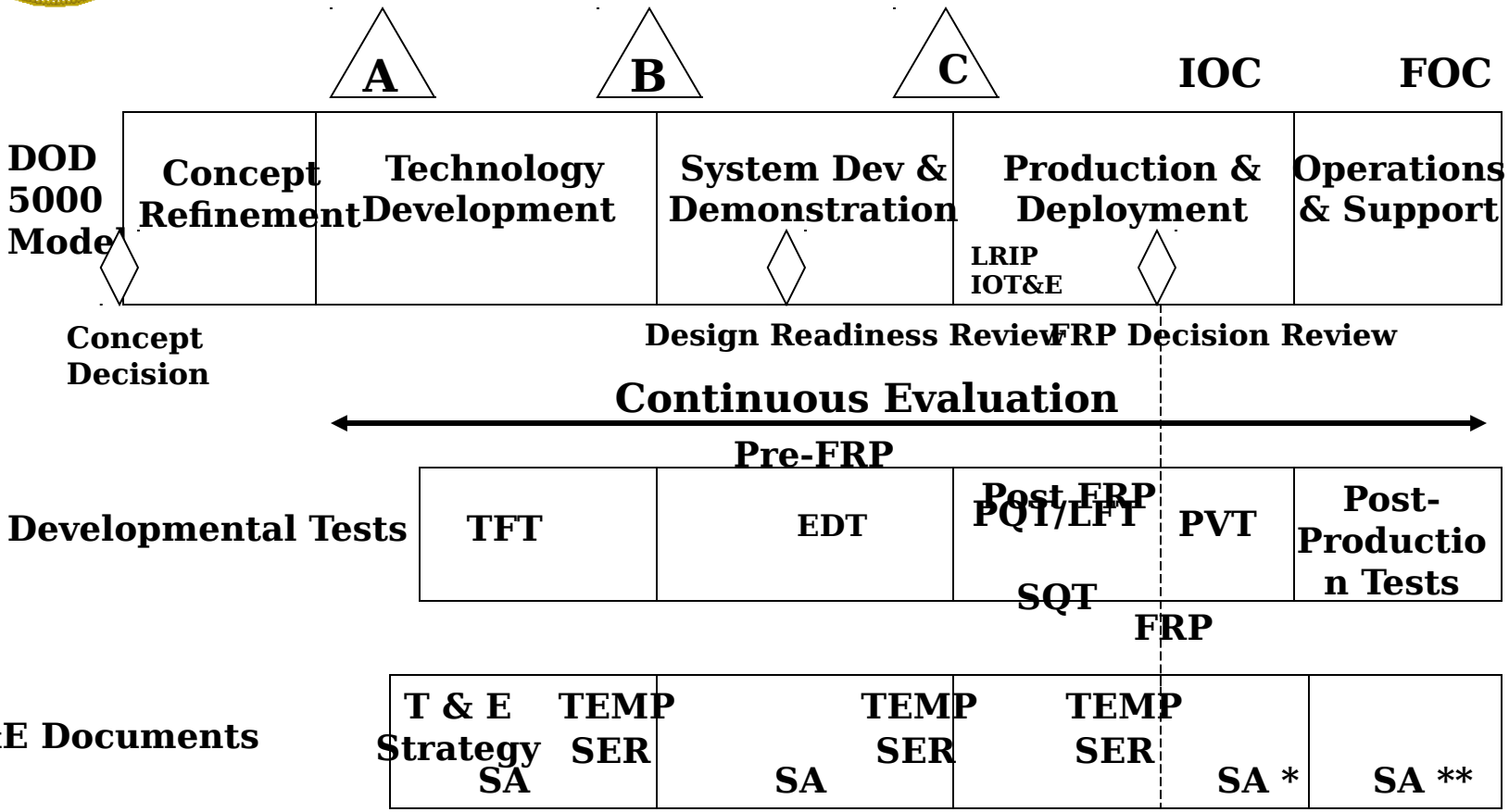


Interoperability

- **Critical in System-of-Systems testing**
- **Software compatibility and interfaces**
- **Network intensive**
- **Command, control, and communications across networks**



DT in the Acquisition Cycle



Test Reports provided at completion of each test to acquisition and user communities

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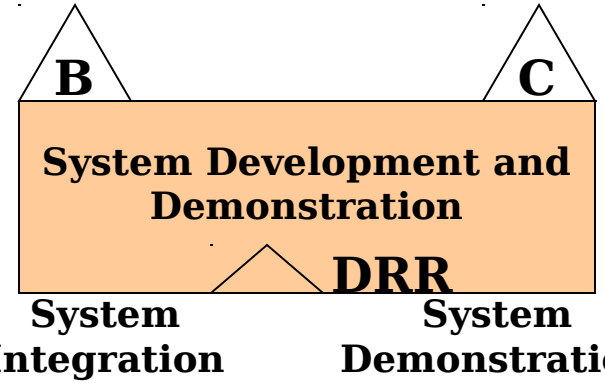
* In support of materiel release process
** In support of Post Deployment Performance Evaluation

Technology Development Phase

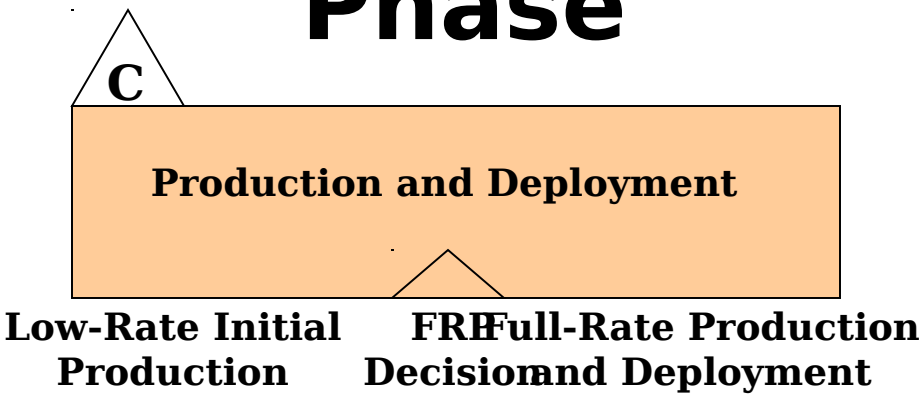
* **Technical Feasibility Test (TFT) to define and evaluate the feasibility of alternative concepts:**
  - **Determine Safety**
  - **Determine Health Hazards**
  - **Establish System Performance Specs**
  - **Establish Feasibility**

System Development and Demonstration Phase



* Engineering Development Test (EDT) to demonstrate system integration in a relevant environment and the system's ability to operate consistent with the requirements
  - Define Technical Risks
  - Demonstrate Safety, Critical Technologies, and Processes
  - Demonstrate Ruggedness, Interoperability, and Compatibility
  - Demonstrate Environmental Effects
  - Demonstrate Achievability of Critical Technical Parameters
  - Support LRIP Decision
* C4/IT Interoperability Certification Test to confirm interface or interoperability requirements with other systems

Production and Deployment Phase



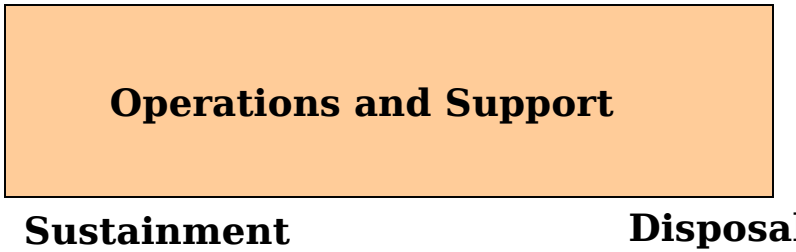
* Prior to Full-Rate Production (FRP) Decision:

- **Production Qualification Test (PQT)/Software Qualification Test (SQT) is a system-level test to ensure adequate and efficient manufacturing capability**
  - ✓ **Ensure readiness for IOT and to support the FRP decision**
  - ✓ **Confirm logistic supportability and ensure safety**
  - ✓ **Ensure design integrity to meet requirements in intended environment**
- **Live Fire Test (LFT) for covered systems to assess vulnerability and lethality**

* Post FRP Decision:

- **Production Verification Test (PVT) to verify system meets CTPs and specifications**

Operations and Support Phase



* To ensure customer confidence, Post Production Tests include:

- Surveillance tests to determine suitability of stored items to
  evaluate the effects of environments, identify failure modes,
  and establish service and storage life

- Reconditioning tests to demonstrate the adequacy of reconditioning activities and quality of item after reconditioning

List of DT Types

Prior to Full-Rate Production

- Research Effort or Test
- Technical Feasibility Test
- Engineering Development Test
- Production Prove-out Test
- Logistics Demonstration (Log Demo)
- C3I Interoperability Certification Test
- Live Fire Test (LFT)
- Production Qualification Test (PQT)

Post Full-Rate Production

- Production Verification Test (PVT)
- First Article Test
- Quality Conformance/Acceptance Inspection
- Post-Deployment Software Support (PDSS) Test
- C3I Interoperability Re-certification Test
- Surveillance/Stockpile Reliability Tests
- Reconditioning Tests
- Comparison Tests

DOD Guidance
Readiness for IOT&E

DODI 5000.2 OT Readiness Process Guidance:

E5.6.1 "The process shall include a review of DT&E results; an assessment of the system's progress against critical technical parameters documented in the TEMP; an analysis of identified technical risks to verify that those risks have been retired during developmental testing; and a review of the IOT&E entrance criteria specified in the TEMP. Programs shall provide copies of the DT&E report and the progress assessment to USD(AT&L) and DOT&E ."

Elevates the significance of well-planned DT in verifying readiness for IOT

Test Concept Planning Process

- **Early integration of DT and OT planning to minimize risk in OT**
  (IOT Entrance Criteria)
- **Optimize testing and evaluation to maximize fielding success**
- **Initiated during System Development & Demonstration Phase**
- **Establish a *Unified* & "Ideal" test and evaluation plan**
  - **Focused on System Capability and Design**
  - **OT Entrance Criteria**
  - **Documentation on Risk Evaluation**
- **"Ideal" T&E plan presented to the PM; changes negotiated and approved**
  - **Resource constraints**
  - **Risks identified**

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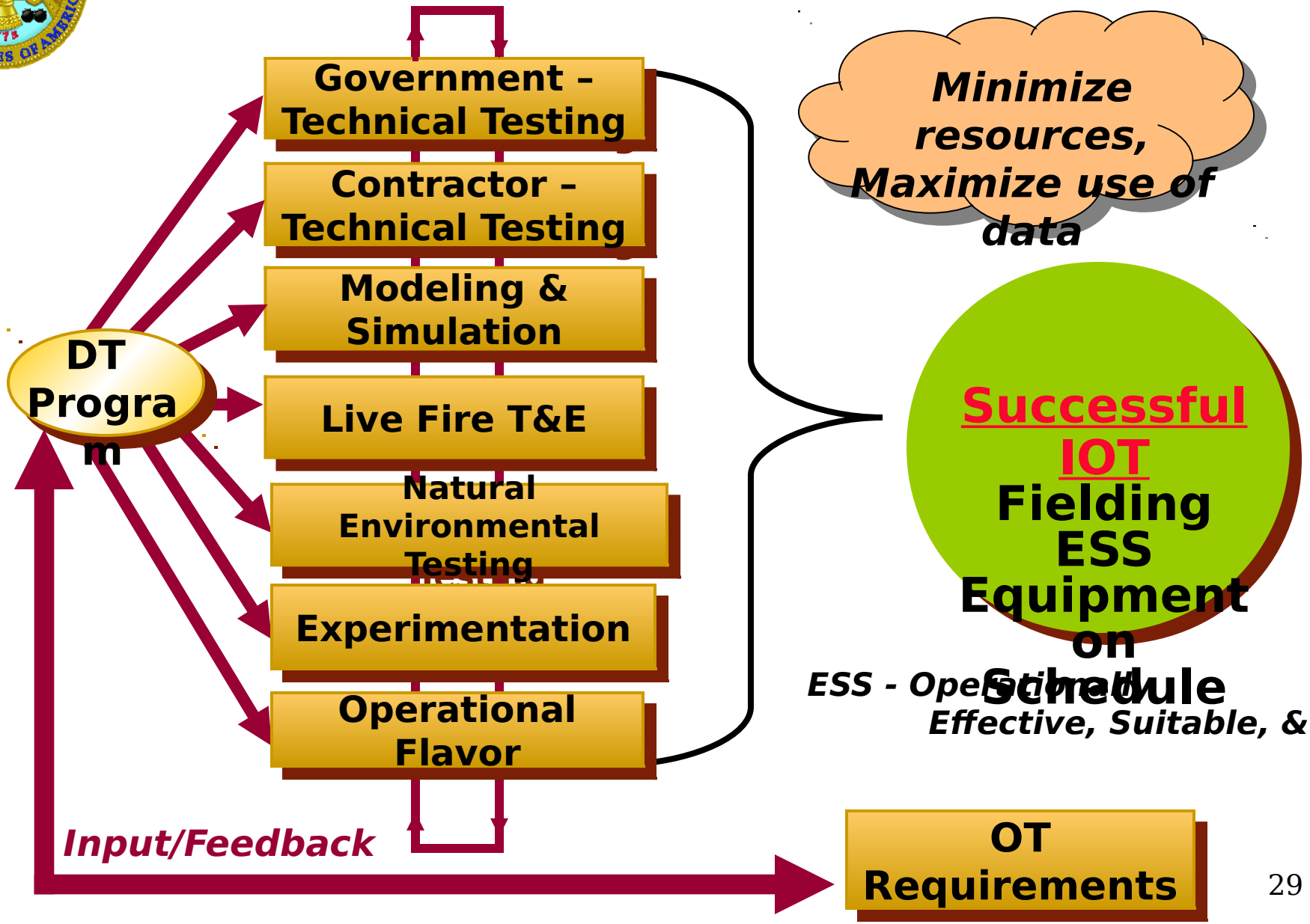
Unifying the DT Program



Contractor and/or Government Developmental Tests at Non-DTC Locations

- **What it must be:**
  - **Part of overall plan from the outset**
  - **ATEC review of testing contained in RFP and contracts**
  - **Must meet same standards as government conducted testing at DTC ranges or facilities**
  - **Government monitoring to verify test conduct IAW test plans and test standards**
  - **Opportunity to collect data, save money & time, and serve as a source of information**
  - **Testers to be involved in Source Selection Evaluation Board activities, as appropriate**
- **Cautions:**
  - **Difficult to verify results**
  - **Systems tested in sterile environment**
  - **Tested on component versus system level**
  - **Need to match requirements document and contractual requirements**
  - **Control over tests and test sites**

Summary

Challenges

- **Getting in early to harmonize DT with program development (schedules and resources)**

- **Recognition of specific DT events as indicators of IOT readiness**

- **Adequate resourcing**

- **Supporting Rapid Acquisition Initiatives (RAI)**
  - ✓ **Ensuring Soldier safety for rapid equipping**

What Is Needed

- **Opportunity for early T&E involvement**
  - ✓ **Requirements generation**
  - ✓ **Acquisition Strategy**
  - ✓ **RFP development & SSEB participation**
  - ✓ **Contractor test program**
  - ✓ **Modeling & Simulation**
- **Access to contractor test plans, reports and data**
- **Work to build an optimal DT program**

Working together to build successful programs!

Bottom Line

DT must:

- **Begin early**
- **Be flexible, yet controlled and repeatable**
- **Be the principal tool to support design maturation, determine technical maturity, and determine readiness for IOT**
- **Provide cost effective technical data to support the evaluator and decision makers**

Acknowledgement & Feedback

This module is a part of the T&E Managers Committee (TEMAC) T&E Refresher Course.

Request your feedback. Please contact -

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